

What is Claimed is:

1. A vertical field effect transistor comprising:
a microelectronic substrate including a trench, the trench defining a sidewall;
a conformal monocrystalline silicon layer on the sidewall of the trench, the
5 conformal monocrystalline silicon layer on the sidewall of the trench including a drain
region adjacent the substrate, a source region remote from the substrate and a channel
region between the source and drain regions;
a plug in the trench that includes the conformal monocrystalline silicon layer
on the sidewall thereof;
10 a gate insulating layer adjacent the channel; and
a gate electrode on the gate insulating layer opposite the channel.
2. A field effect transistor according to Claim 1 wherein the conformal
monocrystalline silicon layer on the sidewall of the trench is a continuous conformal
15 monocrystalline silicon layer on the sidewall of the trench.
3. A field effect transistor according to Claim 1 wherein the conformal
monocrystalline silicon layer on the sidewall of the trench comprises spaced apart
conformal portions of the conformal monocrystalline silicon layer on the sidewall of
20 the trench.
4. A field effect transistor according to Claim 1 further comprising:
a first layer on the substrate; and
a second layer on the first layer opposite the substrate;
25 wherein the trench extends in the first layer and the second layer; and
wherein the gate insulating layer and the gate electrode are between the first
and second layers.
5. A field effect transistor according to Claim 4 wherein the first and
30 second layers comprise phosphosilicate glass and/or borosilicate glass.
6. A field effect transistors according to Claim 1 wherein the plug
comprises high dielectric constant material.

7. A field effect transistor according to Claim 1 further comprising a silicon layer between the microelectronic substrate and the drain region.